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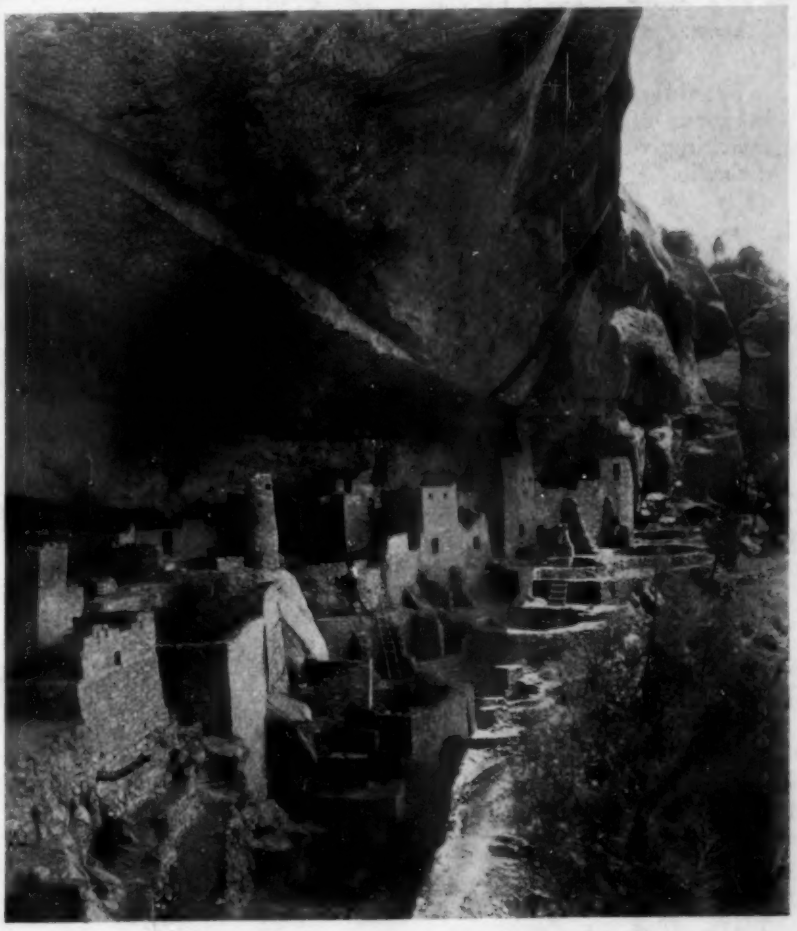
SCIENCE NEWS LETTER

THE WEEKLY SUMMARY OF CURRENT SCIENCE •



JANUARY 23, 1937

Self-Poisoned?

See Page 58

A SCIENCE SERVICE PUBLICATION

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The Weekly Summary of

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Edited by WATSON DAVIS

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DO YOU KNOW?

The cashew nut is a native of America, found notably in Brazil.

There are about 3,000 miles of streets in Greater New York.

A cotton drier devised in 1930 by government scientists is gaining wide use in the South.

Practically every State in the Union has recorded earthquakes within the past 160 years.

The old Roman version of "an apple a day keeps the doctor away" was that eating cabbage would help ward off sickness.

By aid of an electric stethoscope, heartbeats of people before and after exercising were broadcast recently by the radio.

Attempts to grow the Cedar of Lebanon in New England failed when botanists brought seedlings from Palestine; but when some were brought from a colder region, north of Palestine, the Arnold Arboretum at Harvard University succeeded in growing these famous trees and some now stand almost 40 feet high.

Columbus brought the first cows to America, in 1493.

The International Committee for Bird Preservation has extended its study of migratory birds to 26 countries.

The secret societies of American Indians are pronounced strikingly similar to college fraternities and lodges.

By a freezing process, raw, greasy wool can be rid of much grease, as well as vegetable matter such as burrs.

Some of the newest schoolhouses have large sections of wall made of glass blocks, for light and for advantages of insulation.

Telephone booths can now be constructed so that one side remains open and yet noises outside do not disturb the phone user.

The big new hospital to be built at Melbourne, Australia, will have the inside walls and partitions movable, so that wards and rooms can be adjusted.

Sparrows are the Joneses or the Smiths of the bird world—one-seventh of the birds in North America are members of sparrow families.

WITH THE SCIENCES THIS WEEK

Most articles are based on communications to Science Service or papers before meetings, but where published sources are used they are referred to in the article.

ARCHAEOLOGY

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PUBLIC HEALTH

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Is the influenza epidemic becoming more severe? p. 60.

What should you do during an influenza epidemic? p. 60.

RADIO

Where are four-inch radio waves being studied? p. 56.

PHYSICS

Expanding Universe Theory Receives Blow in Discussions

Hypothesis that Rushing Apart of Distant Nebulae Causes Red Shift of Light Fails to Stand Mathematical Check

THE FAMOUS theory of cosmogony of the expanding universe, which postulated some primeval explosion that sent the stars and galaxies rushing apart, has received a serious blow. The attack occurred in scientific discussions honoring the memory of the Notre Dame chemist and botanist, Father J. A. Nieuwland, whose basic discoveries led to the development of synthetic rubberlike compounds.

Prof. Arthur Haas, famous Viennese theoretical physicist now on the staff at Notre Dame University, presented mathematical arguments and calculations showing that the famous observed red-shift of light from the distant nebula can hardly be due to an expansion, or rushing away, of these cosmic bodies from some central point. The interpretation of the red-shift as due to a velocity of motion has been the backbone of the expanding universe theory so often associated with the name of Abbé G. Lemaitre, noted Belgian scientist-priest.

Prof. Haas calculated the amount of energy which matter can create in a unit volume of the universe and finds it far too little to overcome the gravitational attraction that must be overcome if the different parts of the known universe are rushing away from one another in a super-expansion.

This new attack on the expanding universe comes close on the heels of the recent statement of Mt. Wilson Observatory's famed astronomer, Dr. Edwin Hubble, who admitted in a Carnegie Institution of Washington lecture that one could now either consider the universe expanding or not; with perhaps a shade of evidence on the side of the not.

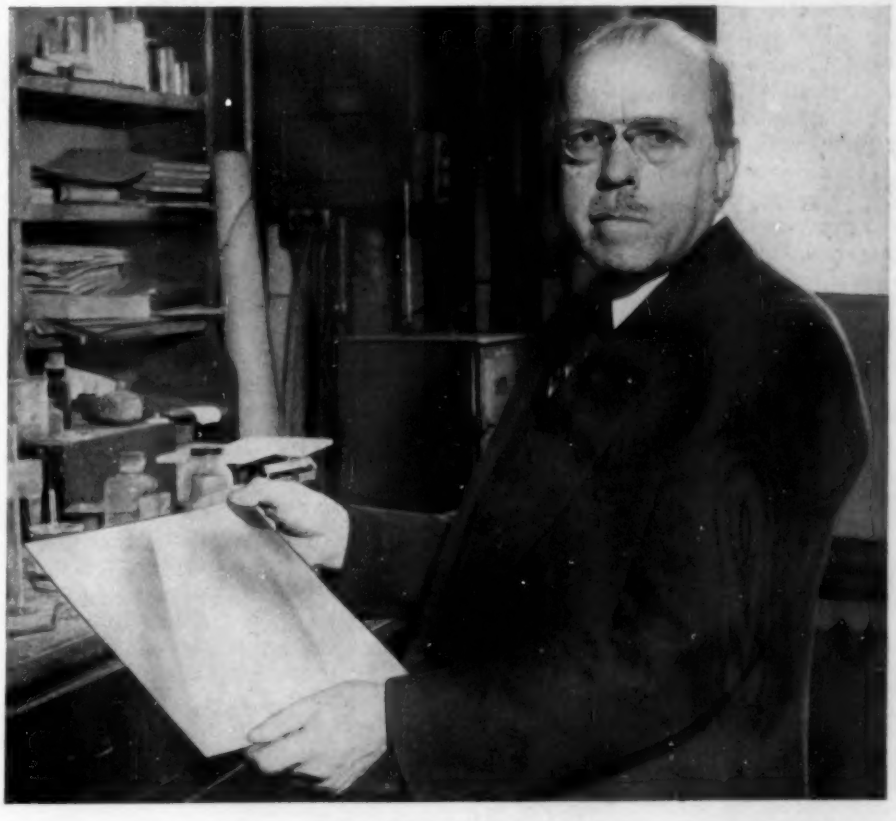
Prof. Haas backed up his arguments by also making calculations showing the amount of energy per gram of matter which would be required to double the mutual distances between nebulae in a system of mutual density. His conclusions from this calculation were:

"A nebular system which exhibits the average mass density observed in the extra-galactic region and which has already experienced a doubling of its linear dimensions, cannot possess a radius of more than about 6,000 million light years. This result seems remarkable because, if in the nebular system there is any expansion at all, we must assume that at least a doubling of the linear dimensions has already taken place. This conclusion cannot be evaded since a doubling requires only 1,300 million years, whereas the age of some terrestrial minerals was found to be 2,000 million years."

If astronomers abandon the idea that the reddening of the light from the distant nebula is due to their velocity of expansion then some other concept must be introduced to account for the observed red-shift.

Somehow or other the light from these far-away nebula has to lose energy en route so that its color is slightly redder than it was when it started. One idea would be that inter-galactic dust in the path would absorb some of the light ray energy.

But Prof. Haas demonstrated by calculation that the loss of radiant energy is of the same order of magnitude as the energy-production of matter. And he concluded by showing that every photon of radiant energy—whether it has high energy and short wavelength like an X-ray or low energy and a long wavelength like a radio wave—loses the same energy in traveling one single wavelength. This concept would account for the observed red-shift in light from distant cosmic sources.



BETTER TIN PLATE

Prof. Colin G. Fink, electrochemist of Columbia University, holds a rare sample of electroplated tin which may soon produce better and cheaper tin cans. A major trouble of the present dipping process for putting the tin on tin cans is that a thick coating is applied and yet it often has as many as 1000 pinholes per square foot. Professor Fink's electroplating process applies a very thin coating with a mirror-like finish in which the pinholes are absent. Commercial production of the process is expected in 1937.

Big Molecules from Little Ones

The synthetic chemist's task of making big molecules out of little ones, which was the aspect of chemistry that held Father Nieuwland's own professional attention for many years, was discussed by Prof. Hugh S. Taylor of Princeton University. In building up these giant molecules, to make such things as artificial rubber, the proportion of the elements in the compounds may not change during the process, but the arrangement of their atoms does change radically, and this rearrangement of the building-blocks largely determines the properties the new substance will have, Prof. Taylor said.

Father Nieuwland's Work

Father Nieuwland's important work in chemistry, culminating in the discoveries that made the production of artificial rubber practicable, occupied a relatively short part of his life, William Stansfield Calcott, director of the Jackson Laboratories of the E. I. duPont de Nemours Company, pointed out. For a good many years he was so busy with his duties as professor of botany at Notre Dame that he gave little time to chemistry. But when he did return to his test-tubes he produced results rapidly.

He was always more interested in the processes, the reactions, involved in his experiments than he was in the final products, Mr. Calcott said. And he would never report on a piece of work until he had all the facts nailed down. Once, making up a compound of acetylene, Father Nieuwland noticed that the resulting gas did not smell exactly "right." He held up publication on this research for several years, until he was sure what the strange-smelling stuff was. It proved to be divinyl acetate —now the basis of a major industry in synthetics.

Botany, the second career of the noted scientist, remained his avocation after he had abandoned it as a profession in favor of chemistry. Dr. Marcus Ward Lyon, formerly of the U.S. National Museum, discussed this aspect of Father Nieuwland's work. He spent long days afield, collecting, and was equally industrious in the study of botanical history. He built up an exceptionally fine library of rare botanical works for his university. His own personal bookplate, Dr. Lyon disclosed, bore the design of a flower, with the Latin inscription for "Consider the lilies of the field."

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PUBLIC HEALTH

Scientists Risk Lives in Carbon Monoxide Research

RISKING their lives for the past six months in an effort to learn more about the effects on the human body of carbon monoxide gas, one of man's deadliest enemies, six "human guinea pigs" of the Harvard Fatigue Laboratory have found that the average man can stand the gas only until his blood is one-third saturated with it.

At the same time they confirmed previous findings that very tiny concentrations of the gas can bring man to this breaking point. Only one part of the gas in a thousand parts of air, for example, breathed for half an hour or so, can render a healthy man unconscious. That is, if he is not active—if he is driving a car, for example. If he is exercising vigorously, he will succumb even sooner.

They also added significant biological proof of a familiar lesson, a lesson emphasized by the mounting toll of deaths from carbon monoxide poisoning throughout the nation. It is the fact that the insidious poison gives absolutely no warning of its presence or even that it is stalking its prey.

Not only is the gas colorless and odorless, as has been known for some time, but in addition, it has been found, a man breathing it feels no ill effects, not even drowsiness. He just collapses without warning. If he is driving his car, if he is alone in a garage, he may well be doomed.

Dramatic Proof

Most dramatic proof of this was brought to the Harvard experimenters when Dr. W. H. Forbes of the Fatigue Laboratory suddenly fainted after he had just completed tests requiring a high degree of skill. Other workers had to carry him from the gas-filled chamber and revive him. His blood proved to be almost one-half saturated with carbon monoxide.

The experiments, conducted cooperatively with the Harvard Bureau for Street Traffic Research, were directed by Dr. David B. Dill, assistant director of the Fatigue Laboratory, Dr. Harry de Silva of the Bureau, Dr. Forbes and F. M. Van Deventer of the Cities Service Refining Company whose survey to the effect that about five per cent of automobiles and closed trucks examined on highways have dangerous concentrations of carbon monoxide led to the research. These men and two students volunteered for the tests.

The plan of the experiments was to admit the deadly gas in known concentrations and amounts into a closed room in which the "human guinea pigs" were being tested at regular intervals for their reaction time, judgment, perception, and other automobile driving skills. Blood samples were also drawn at intervals to determine the percentage of saturation with the gas. In all experiments the subjects showed no decrease in skill even when their blood was about one-third saturated and they were practically ready to collapse.

Tests were limited to these simulated driving conditions although it is hoped ultimately to extend the investigation to include tests directly concerned with the operation of automobiles.

Science News Letter, January 23, 1937

PHYSICS

Gravity Value Determined At Bureau of Standards

USING special pendulums of fused silica, the most precise measurements on the absolute determination of gravity ever made have just been announced by the National Bureau of Standards. Dr. Paul R. Heyl and Guy S. Cook performed the measurements which fix the acceleration of gravity at Washington to be 980.08 centimeters per second per second.

For years the measurements made at Potsdam, Germany, in 1906 have been the international base determination by mutual consent of scientists. Although the Washington scientists made fewer observations than did the German investigators, the accuracy of individual readings is higher, so that the average value obtained is comparable in accuracy.

The new Washington value differs from the value at Potsdam by 2 parts in 100,000. Whether the new value will be widely accepted, as was the 1906 in Germany, can only be determined by the future.

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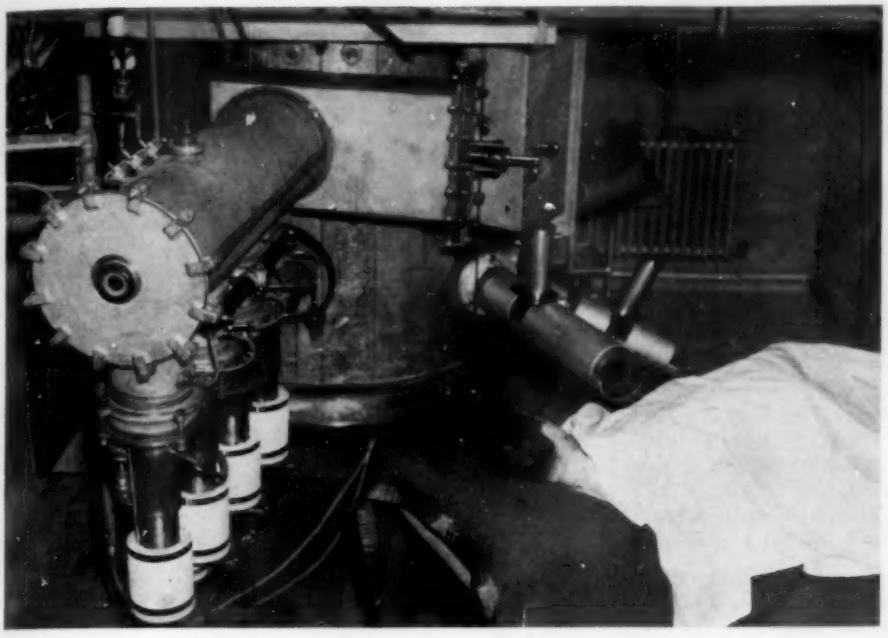

TO BATTLE CANCER

The outlet tubes of this giant X-ray machine, directed at the patients, permit only a narrow beam of X-rays to strike them at the proper places for the therapy.

PHYSICS

New 1,200,000-Volt X-Ray Machine Aids Cancer Fight

NEWEST aid of science in the fight on cancer was revealed as the giant 1,200,000-volt X-ray machine of Columbia University's Institute for Cancer Research. Dr. Francis Carter Wood, widely known cancer specialist and director of the Institute, exhibited the apparatus which took two years to construct.

Uniqueness of the new development, which makes it an improvement over previous apparatus having a comparable voltage, is that it is completely housed in a large steel tank which is continuously evacuated. Both the voltage generating circuits and the X-ray tube are thus shielded from any possible accidental contact. Patients are protected, in addition, by four inches of lead which permits only a narrow beam of X-rays to strike them at the proper places for X-ray therapy.

Five outlet openings for the rays are provided: four for patients and one reserved for research purposes. Cost of the apparatus was $25,000.

The pressing search of science for improved ways of splitting the atom and studying its intricate nucleus is directly responsible for the new Columbia X-ray machine. Back in 1934 Dr. D. H. Sloan at the University of California developed a similar apparatus for accelerating charged particles in atomic bombardment experiments.

It was found, shortly, that by a simple change of only one essential part of the apparatus it was possible to make a highly compact and efficient X-ray machine of high voltage. Such an apparatus was built for the University of California Medical School and the present Columbia equipment is copied and improved in design over this prior equipment.

In operation the new type X-ray machine utilizes 15,000 volts of alternating current electricity and applies this to twin radio oscillator tubes generating radio waves 50 meters in length, in the shielding tank. The electrical circuit of these tubes is so designed that when resonance is obtained more than 200,000 watts of electrical power flows in the hollow copper tubes of the equipment. Swift-flowing streams of water help dissipate the great heat generated.

Eight hundred thousand volts potential have been obtained in Dr. Sloan's original apparatus and the Columbia equipment has already been operated at 1,200,000 volts. Upper potential limit of the design is limited only by the effectiveness of cooling the enclosed apparatus. Potential 5,000,000 volts could be obtained with existing oscillator radio tubes if there were any way of cooling the apparatus and making it work without burning up.

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PHYSICS

Relativity and Quantum Theories Are Harmonized

ALTHOUGH they may not understand the exact research being done, most laymen have a rough idea of what an experimental physicist does in his experiments; how he sets up controlled conditions and then takes measurements with great patience and much ingenuity.

Less clear, perhaps, are the doings of the theoretical physicists who use only paper and pencil and the rules of mathematics as found in scientific literature or stored in their head. The layman may well ask: "What do famous men like Einstein, Eddington, Dirac or De Broglie think about? What problems are they studying? And why are they interested in them?"

The new book "Relativity Theory of Protons and Electrons" (Macmillan) by Sir Arthur Eddington gives a partial answer to these questions. Sir Arthur may be best known throughout the world for his popular books on science but the reading public who devoured Eddington's "Nature of the Physical World" will be disappointed if they expect something similar in his new volume.

Here Sir Arthur writes strictly for his fellow scientists and rounds up his thinking on some means of harmonizing two great physical theories—Relativity theory with its wide usefulness in the scale of larger things, and Quantum theory which works with equal success in the tiny world within the atom. Relativity treats matter as continuous while quantum theory breaks things up into discontinuous units and handles them accordingly.

The hitch has been that quantum theory, as a younger upstart, has been surprisingly successful in getting along without relativity. Cause and effect and rigid determinism was the basis of older thinking. An indeterminate "looseness" in the relationships of physical science is the fundamental concept of the new

lines of attack, so that there is room left within the scheme of physical law for undetermined behavior.

Part of the mystery of atomic physics, points out Sir Arthur, is that man himself unwittingly hides facts. Of this he says:

"The physicist might be likened to a scientific Procrustes, whose anthropological studies of the stature of travelers reveal the dimensions of the bed in which he has compelled them to sleep. Yet I do not think that we take unwarrantable liberties with the universe in our Procrustean treatment of it. If experience is a subject-object relation, the subject is entitled to—nay, he cannot divest himself of—his half-share. It can scarcely be a coincidence that Heisenberg's uncertainty principle has defined the half-way line with mathematical exactitude, distributing a coordinate to one side and a momentum to the other side with perfect impartiality. And so we may look forward with undiminished enthusiasm to learning in the coming years what lies hidden in the atomic nucleus—even though we suspect that it is hidden there by ourselves."

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PHYSICS

New Property of Matter Is Believed Discovered

In One of World's Rarest Minerals, Hackmanite, Evanescent Streaks May Be Revived by Radiation

WHAT may be an entirely new property of matter has been discovered in one of the world's rarest minerals known as "Hackmanite." Found originally in the rugged fiords of Greenland in the early years of the last century and later in the old crater of Italy's volcano Vesuvius, Hackmanite has long been a treasured collector's piece for scientific museums, for its rarity alone. Now a clear variation of the deep blue, lapis lazuli-like mineral may take on the added merit of research value.

Samuel G. Gordon, associate curator of minerals in the Academy of Natural Sciences, Philadelphia, explained the rare mineral and its new found property to Science Service.

The American mineralogist O. Ivan Lee of Jersey City, N. J., has made the strange discovery that a quickly passing red-violet colored streaking of the surface of Hackmanite can be revived at will by radiating the mineral with ultraviolet rays, explained Mr. Gordon.

For many years, continued Mr. Gordon, mineralogists have known that when a clear variety of Hackmanite was fractured, characteristic and beautiful bright red-violet splashes of color appeared on the clean surface. Then, on exposure to ordinary light, they passed away.

Radiation with ultraviolet light, Mr. Lee has found, brings back this lost property at will and as many times as one wanted to perform the experiment.

The first thing which one might think of to explain this strange revival of a color-death would be fluorescence, pointed out Mr. Gordon. But the phenomenon is not fluorescence, at least in the ordinary sense of the term, he added.

The fluorescence of Hackmanite, that is, its brief temporary glowing following exposure to light, is a characteristic salmon pink that cannot possibly be confused with the bright red-violet shade of the revived colors.

Neither is the happening one of phosphorescence, since this property of Hackmanite yields a beautiful blue color.

What really is the true explanation of the effect is thus unknown at present, but at this stage of scientific research when supposedly the external properties of matter, at least, are well known, the discovery takes on added interest. Mr. Lee calls the phenomenon reversible photosensitivity.

Over and above the scientific story of the discovery is the almost fantastic adventure yarn concerning the original discovery of Hackmanite.

Hackmanite was discovered in 1806-08 by an Austrian scientist who later was knighted by Great Britain and finally became professor of mineralogy at the University of Dublin.

The mineral specimens, first found in Greenland, themselves had a topsy-turvy trip until they finally reached their destination.

Charles Giesecke, the Austrian scientist, went on one of the early Danish expeditions to Greenland. He collected specimens of many minerals and shipped them back by a Danish boat, and stayed behind for another six months or a year. But it was seven years before a boat returned to Greenland to pick him up!

In the meantime the mineral specimens on the Danish boat, including what later became known as Hackmanite, were captured by a French privateersman, for the Napoleonic wars were in full swing.

Then, in turn, the French vessel was captured by a British frigate and each time the barrels of minerals were transferred. The barrels were imposing looking and one may reasonably suppose that first the French and then the English thought they had a commercially valuable cargo seizure.

At any rate the Giesecke specimens were finally landed in Scotland at the port of Leeds and eventually found their ways into the hands of mineralogists in Dublin who studied and classified them.

Giesecke, Mr. Gordon told Science Service, earned his education by selling mineral specimens in his native Austria. In addition he is said to have composed several operas.

Besides the Greenland and Vesuvius regions where Hackmanite is found, varieties of it have also been located on the Kola Peninsula in Arctic Russia and just recently in the province of Ontario, Canada, near Bancroft.

The Academy of Natural Sciences Museum has now under shipment from Canada a specimen of this strange, rare mineral.

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POPULATION

Thousands Migrate From the Great Plains

MORE than 27,000 people from the drought-stricken Great Plains areas migrated voluntarily to California during 1936, reports John C. Page, Acting Commissioner of the U.S. Bureau of Reclamation. In addition 2,329 families entered the state of Washington, 1,930 families the state of Oregon and 4,500 families the state of Idaho, hoping to settle permanently.

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ENGINEERING

Railroad Rails Are Twisted, In Tests to Aid Safety

Over 700 Different Kinds of Rails Have Been Frozen, Bent and Punished Beyond Any Strains of Actual Service

By ROBERT D. POTTER

SPRAWLING through the nation in an intricate web of steel are the slim ribbons that carry the country's railroad transportation. Around a great metropolis like New York are hundreds of miles of track that are part of the total 400,000 miles of railroad track in the United States. But beyond the freight, storage and switching yards of any large city extend the mainlines with rails that are husky fellows, weighing from 131 to 152 pounds for every yard of their 39-foot length.

These are the rails in the "big time"; that stand the batter and pounding of the through fast freight, mail and passenger traffic. And each one bears its history stamped in its side; the year and month of its making, the steel mill that made it, the kind of steel used, the heat number and the ingot number.

After from 10 to 12 years of service on the mainline these rails, like baseball players, are no longer fit for the big leagues but they see years of added service on secondary lines, in yards and in spur tracks. But wherever they are, until finally returned to the steel mills for a rebirth as scrap steel, their identity goes with them. About the only thing lacking is a set of ferrous fingerprints.

Now, however, scientists are taking even rail fingerprints in a research to bring even greater safety to the world's safest form of fast transportation. The Association of American Railroads and the rail manufacturers have just tossed another $50,000 chip into the research pot on rail testing for the coming year. An additional $250,000 has already gone the same way into the laboratories of the University of Illinois where Prof. H. F. Moore directs and coordinates the experiments.

So far over 700 different kinds of rails have been studied and punished beyond all possible injury that could be attained in actual service. They have been cooled to frigid temperatures of a northern winter in the cold room of the Army's Wright Field at Dayton, Ohio. They have been bent and twisted in special machines in Professor Moore's laboratory. And for days and months a standard car wheel rolls back and forth over steel rail joints, carrying a load that can be as great as 75,000 pounds, to see what loads can cause fissures. Actually the rail goes to and fro beneath the wheel but the effect is the same.

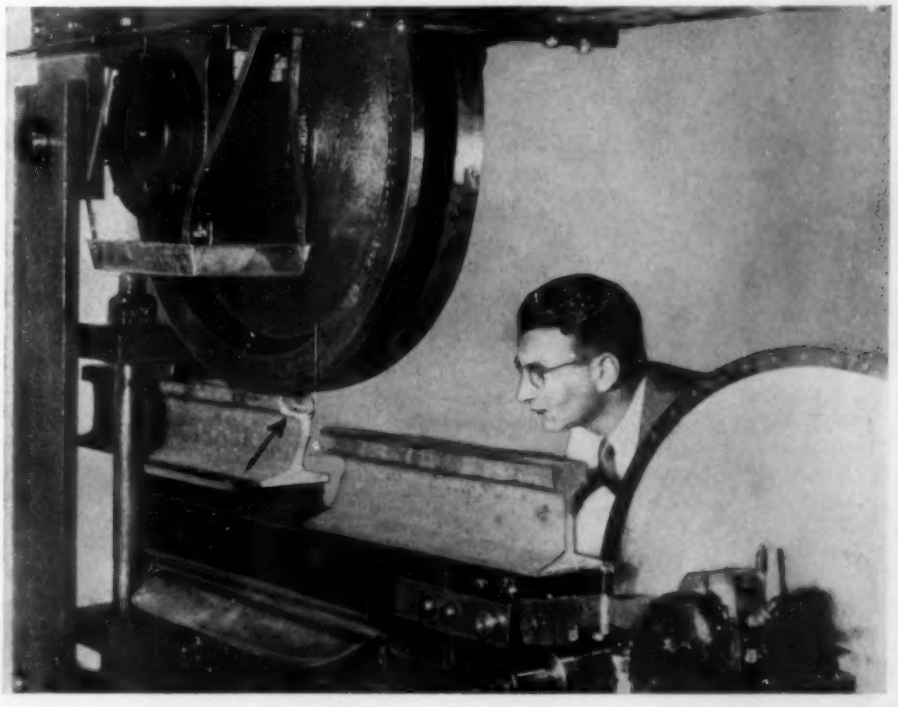
If a steel rail can have fingerprints, the so-called "shatter cracks" of the railroad technologist would take that designation. Some rails have these microscopically small cracks and some do not. One hundred thousand of them side-by-side would equal only one inch in length. Some are so small that they must be etched with acid to make them visible even in a microscope. Yet they must be watched and caught while young for they may develop into transverse fissures which, in a rail, may be compared to cancer in the human body.

Some years ago Elmer Sperry developed the odd-looking rail car which, with underslung electro-magnetic feelers, detected the fissures in an early stage and shot a dab of paint on them so that they could be spotted and removed. Ten thousand defective rails a year are found in this fashion.

But why not find out what causes the shatter cracks in the first place and prevent their formation at all? That is the question the railroads asked themselves and Professor Moore's job is to find out.

One way to cause the unseeable shatter cracks Professor Moore has found is to heat a piece of rail in hydrogen and then let it cool in open air. But it was also shown that by controlling the temperatures of the cooling rails the shatter cracks are prevented.

The rolled rails, at a temperature of from 2,000 to 2,100 degrees Fahrenheit, are allowed to cool rapidly to about 1000 degrees. Then they go into a "cooler box" and take from 20 to 30 hours to come down the rest of the way to room (*Turn to page* 61)



TESTING RAILS

This machine in the laboratories in the University of Illinois batters rails until cracks are artificially created to gain knowledge for increasing railroad safety. At the top may be seen the car wheel which rolls over the track in these tests.

PALEONTOLOGY

Passenger Pigeon Bones In La Brea Fossil Pits

THE passenger pigeon, that remarkable bird that passed from almost unbelievable abundance into complete extinction within a few generations, has "arisen from the dead" to present new evidence concerning its distribution many thousands of years ago.

Listed always as a typical eastern and northern species, there have been no authentic records of its occurrence in California. That at one time it lived in this region, however, is now attested to by the identification of six bones of this famous bird in the Los Angeles Museum collections from the Ice Age asphalt pits at Rancho La Brea, Los Angeles, Calif.

This occurrence in the thinly wooded country of Pleistocene Rancho La Brea, unfortunately, does not provide definite evidence as to the abundance of passenger pigeons in the West at that early time. The species may actually have been as rare as these scant remains would indicate. On the other hand, since in recent times it was always a typically forest-loving bird, it may have been abundant in more thickly forested areas nearby, while rare in the immediate vicinity of Rancho La Brea.

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ASTRONOMY

New Light-Counter Aids Astronomers' Investigations

RESEARCH in radioactivity and cosmic radiation is providing the astronomer with a new and valuable instrument for his investigations. Called the "Geiger-Mueller counter," the device was invented early in this century by Prof. H. Geiger in Germany and improved upon several years ago by Prof. W. Mueller, another German. Its particular claim to usefulness is its ability to detect the presence of a single electron—a single "atom of electricity."

So small is the amount of electricity carried by a single electron that an ordinary ten-watt electric light bulb requires a billion billion of them every second to keep it lit. One can well imagine the value to scientists of any device which will respond to a single one of these atomic particles.

But where does the astronomer come in? He is interested because he is constantly on the look-out for devices to supplement his own eyes in his study of stars. First, and still the most important, of these aids is the photographic plate. Then came the photoelectric cell, an instrument which permits an electric current to flow when light (as from a star, for example) is allowed to enter it.

"Electric seeing" with a photoelectric cell is made possible by the ability of light to remove pieces of electricity (electrons) from metals. From the strength of an electric current the astronomer knows how much light is entering his telescope from the star upon which it is focussed.

But there is a limit to the smallness of an electric current that can readily be measured. Unless the starlight is strong enough to generate thousands of electrons per second in the "photocell" the observer is unaware of its presence. Hence the great appeal of the Geiger-Mueller counter—a counter of single electrons.

Dr. G. L. Locher of the Bartol Research Foundation of the Franklin Institute has reported on his work in the development of Geiger-Mueller counters for astronomical use. Of long experience in the design of such counters for radium research and cosmic ray investigations, Dr. Locher explained that their field of astronomical application has scarcely been touched.

Theoretically the G-M counter's sensitiveness to one electron should enable it to "see" a star a very great deal dimmer than can be studied with a photocell. But unfortunately it is more difficult for light to produce electrons inside G-M counters than in photocells. At the present time their ability to "see stars" is just about equal to that of a good photocell. A definite point of superiority is their ease of handling and Dr. Locher believes that further research will greatly increase their response to very feeble light. Even now they are more sensitive than photocells in certain spectrum bands.

Science News Letter, January 23, 1937

RADIO

Four-Inch Radio Waves Studied in China

RADIO waves only 10 centimeters (four inches) long are being studied by Dr. Meng Chao-ying of Yenching University, Peiping, China. This is a continuation of work he did in America where he was credited with constructing the smallest vacuum tube, producing one-centimeter waves.

Science News Letter, January 23, 1937

IN SCIEN

FORESTRY

Fire "Bad Medicine" For West's White Pine

FIRE in the forest, which is now actually used in the South as a tool for the control of yellow pine timber growth, is still wholly "bad medicine" for Western white pine.

So declares E. F. Rapraeger of the U.S. Forest Service, who has recently completed a study of fire effects in the great historic timberlands of Idaho, which Lewis and Clark saw on their famous exploration trip during the presidency of Thomas Jefferson. Mr. Rapraeger has studied extensive areas of Western white pine in this region, and finds that the effects of even "mild" ground fires are never beneficial.

He found that fire damage was discernible in three different ways: through understocking and reduced yields, through decay started in burn-wounds on the trees, and through the encouragement of excessive branching which results in rough timber of lowered market value.

Mr. Rapraeger concludes: "Evidently complete protection from fire is essential from infancy to maturity if the aim is to grow Western white pine of high quality."

Science News Letter, January 23, 1937

PHYSICS

New Musical Instruments Invented in Russia

AN INSTRUMENT resembling the organ, which produces sounds of oriental music as well as those of western music, has been invented by A. S. Ogoltevets. The octave of this instrument has 17 intervals.

Demonstrated before the Academy of Sciences of the U.S.S.R., the new instrument won high praise, Tass, official Soviet news agency, reports.

Soviet musical inventors have produced interesting results by using electricity to intensify the sound of violin and guitar music. Recent electric musical instruments introduced include the Emiriton, Violena and Equodin.

Science News Letter, January 23, 1937

ENE FIELDS

ARCHAEOLOGY

Bricks Help To Trace Early Western History

ADOBE BRICKS from ruins of a Dominican mission in Lower California have preserved evidence of a smallpox epidemic that ravaged the Indian population in 1781.

Two California scientists who have been examining bricks from old missions made the discovery of bones in bricks from San Vicente mission. It is supposed that builders of the Mission must have shoveled in bone fragments from unmarked graves of smallpox victims when they were getting earth to make the brick.

Mission bricks are yielding many clues to early western history, according to the two brick investigators, Prof. G. W. Hendry of the University of California, and M. K. Bellue of the State Department of Agriculture. On some bricks are footprints of men, dogs, coyotes, birds; and in other bricks have been found nut shells, leather trimmings, pottery, copper fragments, and seed of plants grown in early days in the west.

Science News Letter, January 23, 1937

MATHEMATICS

Famous Mathematical Problem Solved at Chicago

HAILED as one of the greatest recent advances in the science of numbers, Prof. Leonard Eugene Dickson of the University of Chicago has produced the first rigorous proof of an extension of one of the problems that has wrinkled the brows of mathematicians since the Middle Ages.

Ranking with the famous and impossible trisection of the angle as a brain puzzler, the task Prof. Dickson set himself and solved is what is called "additive number theory" or the "Waring problem."

In its simplest form, the one that was discussed during the middle ages, the problem concerns the fact that every whole number is either an exact square or the sum of two, three or four squares. By a coincidence, the famous mathematician Fermat in 1636—the year of the founding of Harvard which is now being celebrated—first discovered the general theorem.

Many of the best brains in the world have set themselves the task of working out the rules, formulae and proofs, and as early as 1772, a mathematician named Euler—son of a more celebrated mathematician—worked out the formulae for any power.

Amateur mathematicians may wish to ponder over it. Here it is. To express any number as the sum of two other numbers raised to any selected power, for convenience designated mathematically by the small number n, the maximum number needed of numbers so raised to the selected power is found by raising two to the selected power, subtracting two and then adding the fraction three over two raised to the selected power, discarding the decimal fraction.

For squares the answer is four, for cubes it is nine, and for fourth powers it is 19, for fifth powers it is 37, and so on.

Mathematicians know and have confidence in this rule but it had never been rigorously proved for any but squares and cubes.

Proved For all Powers

Prof. Dickson's achievement is to prove it rigorously for all powers from the seventh power to infinity powers.

How did he do it? He did not even try to tell in the one lecture he gave. He explained that it would take 120 lectures to mathematically-trained listeners to give full proof.

There are still three powers in additive number theory that have not yet been conquered, the fourth, fifth and sixth powers. Prof. Dickson believes that, given time, he will work out the proof of these also.

Prof. Dickson glories somewhat in the impracticality of this particular branch of mathematics. It has been useful in the mathematics of the new quantum theory of physics, wave mechanics, and so on. But it hardly is useful as yet to practical chemists, physicists and engineers who apply science to everyday life. That does not mean that it will not be useful in the future.

Going back to the formula for a minute, Prof. Dickson on the back of an envelope worked out the maximum number of terms in a series of seventh powers that will add up to any number. It is 143. Got a pencil and paper? You can work it out for yourself.

Science News Letter, January 23, 1937

PUBLIC HEALTH

Pointed Lollipop Stick Is a Death Weapon

"POTENTIALLY a lethal weapon," the pointed lollipop stick must be outlawed, believes Dr. William A. Schonfeld, New York physician.

Lollipops on blunt sticks may be permitted to a child but he should be cautioned against running about with one in his mouth.

Following the recent death of a two-year-old patient, Dr. Schonfeld becomes a militant crusader against the pointed lollipop stick. He describes the little boy's sad death from infection following a lollipop injury in the forthcoming issue of The Journal of the American Medical Association (Jan. 16).

The little boy fell down with a lollipop in his mouth and the sharp stick penetrated the hard palate. He cried but there was no bleeding and the parents never discovered the site of the injury.

Eight days passed, and the little boy fell ill. Six days later he was dead, in spite of medical treatment. Infection, Dr. Schonfeld discovered, spread along the pterygopalatine canal, causing inflammation of connective tissue. This spread to the brain, producing local meningitis, encephalitis and abscess of the outer membrane of the brain.

Some candy manufacturers favor the pointed lollipop stick because it speeds up production, Dr. Schonfeld states. Parents should forbid the purchase of these lollipops at all times.

Although injuries from lollipop sticks are frequent, they are usually innocuous, the physician finds. Only occasionally do they lead to serious complications and death. Most of them are preventable.

Science News Letter, January 23, 1937

MEDICINE

Acid Destroys Gallstones Dog Experiments Show

GALLSTONES apparently can form and survive only by "staying on the alkaline side," it appears from the report of researches by Dr. Maurice Feldman and associates of the University of Maryland School of Medicine. They implanted human gallstones in the gallbladders of dogs. The stones dissolved, apparently because dog bile is more acid than that found in the human gallbladder. Gallstones similarly implanted in guinea pigs, which have alkaline bile, failed to dissolve.

Science News Letter, January 23, 1937

ARCHAEOLOGY

America's First Slums

Ancient Indians in the Picturesque Pueblos of the Southwest Suffered From Crowding and Unsanitary Homes

By DR. FRANK THONE

See Front Cover

SLUMS, and the manifold evils that they breed, are no new thing under America's sun. Slum-like conditions obtained among the Pueblo Indians of the Southwest when white men first saw them—had existed, indeed, for nearly half a thousand years before the first exploring parties of Spaniards penetrated into what is now the state of Arizona.

And these same ancient-American slum ways of living have been in large measure responsible for the decline of the Pueblo population, once ten times more numerous than it is today in the uplands of northern Arizona. So at least declares Dr. Harold S. Colton, director of the Museum of Northern Arizona, at Flagstaff.

Slum life killed off the Pueblos in exactly the same way it kills off the wretched poor who house miserably in the East Sides of the white man's cities, Dr. Colton charges. Crowded indecently together, ignorant of the elements of sanitation, lacking the means to practice it even if they had the knowledge, the people swallow disease-polluted water. And so they die—especially the children.

A Major Cause

Of course, Dr. Colton does not mean to imply that unsanitary living conditions were the only thing that brought the Pueblos to their present low estate. In anything so complex as the course of a human civilization, there are always numerous factors at work. One of the idlest occupations of the amateur historian is the search for "the" cause of the Fall of Rome. Similarly, it were idle to speak of "the" cause of Pueblo decline. Nevertheless, among the things that brought about the decline, crowded living and the diseases of poor sanitation must be reckoned as well toward the top, the Arizona archaeologist believes.

Pueblo architecture has always had a strangely glamorous attraction for white men. In the very earliest days of Spanish settlement in Mexico, wonder-tales of the shining Seven Cities of Cibola, built all of silver, lured Coronado and his hardy band into their magnificent but disappointing quest, that carried them as far as Kansas before they owned their defeat and went home. They saw and marvelled at these piled-up cities of the Indians, unlike any other native architecture and far advanced beyond the unpretentious dwellings of neighboring tribes. But they weren't built of silver, and their inhabitants had no gold, so the Spaniards passed them up and pushed on after their Midas-mirage, that mocked them over horizon after horizon.

Later comers, Spanish and Saxon alike, have felt the fascination of these strange houses, and have become romantic about them. They have come to dominate much of Southwestern architecture, from artist's studio at Taos to humble hot-dog stand by the highway. Recent Americans have taken a curious pride in pointing to their piled-up rooms on rooms as this country's first apartment houses.

Nothing to be Proud Of

As if apartment houses were something to be proud of at all! Even at best, our city apartment buildings are a concession to necessity, and are made tolerable only by all the expensive modern improvements that can be built into them: elevator service, plumbing, electric lighting, good ventilation and ample windows. If they lack these things, they are not dignified with the name of apartment houses but are called tenements, and slum clearance agencies size them up speculatively and reach for an ax.

But the Indian pueblo, stripped of all its romance, has even fewer conveniences than a city tenement. It is a "walk-up" of the most primitive type, with ladders instead of stairs. It is as innocent of plumbing as it is of windows. Water has to be brought in from a distance in earthenware jars, and household wastes of all kinds are simply thrown out on the ground nearby. If it didn't stand in a desert, where sun and wind quickly render such slops as nearly innocuous as possible, the place would be simply intolerable.

This is not in any way an indictment of the people who built it and have lived in it for centuries. They have worked within the limits of their primitive knowledge, and within those limits have done a really remarkable job. Probably white men, planted in a similar environment, with no more materials and no better tools, could not have evolved even as good an answer to the challenge of their surroundings. Nevertheless, disease germs are no respecters of ingenuity or effort, unless these are unremittingly applied to the task of disease prevention. This gap in the Indian's knowledge is a weak place in his life-armor. And he has paid the price.

Rains Add Hazard

If the Pueblo Indians only dwelt in a total desert, rainless the year round, their unsanitary way of throwing out household wastes would not constitute a particularly bad health menace. Quickly dried by strong sun and wind, the garbage and household litter lock up the germs and hold them fast. Germs must have a watery medium to live in, if they are to develop their evil powers.

But Pueblo-land is visited by more or less regular rainy seasons. Water accumulates in puddles around the houses —what its bacterial count must be does not require much imagination to picture. And as if to make the operation of the death-trap doubly sure, the Indians attach a ceremonial value to water that has thus been given directly from on high. Mothers give it to their children, and indignantly reject suggestions by meddlesome white men that it may not be very good for the little ones.

In 1934, says Dr. Colton, almost all the children in two large pueblos in northern Arizona died. The agent of the Indian Bureau blamed it on too much watermelon!

The population of Pueblo-land was not always kept at its present low level by such suicidal community self-poisoning. Dr. Colton has worked out an estimate, on the basis of archaeological evidence, that about the year 1000 A.D. there were some 23,000 Indians living in northern Arizona, in place of the present 2,800. That is a really large number of mouths for so arid a land to feed, yet they seemed to be well supported by their irrigated patches of corn, pumpkins, beans, and peppers. Even more remarkable is the fact that they had built up this large population

HOLY

The puddle in the middle of this Pueblo street is holy water to the Indians although filth makes it deadly to drink. This photograph was taken by the National Geographic Society's Pueblo Bonito Expedition.

from a beginning of perhaps 3,000 persons in 600 A.D.

But after this high peak in their fortunes, the Pueblo population began to decline. By 1400 A.D. there were only 7,400 of them, and in 1890 the lowest point was reached, with a remnant of 2,000 souls. Since then they have held their own, and increased very slowly against the handicaps that beset them.

Why should the very peak of their good fortune mark the beginning of their decline?

Changed Their Ways

Dr. Colton thinks that a sudden revolution in their way of living had a good deal to do with it. It was just after they reached their point of greatest numbers that these tribes gave up their old, scattered, one-family dwellings and began to crowd into the swarming, tenement-like pueblo type of houses, with their deadly lack of sanitation.

The earliest ancestors of the Pueblo Indians lived in houses radically different from those their descendants now occupy. They were more or less nomadic hunters, and like all hunting populations their total number was relatively small and probably fluctuated a good deal, in response to abundances and scarcities in game. Their houses were of the type known as pit dwellings, a kind of habitation still used very widely by Indians throughout the West, from the earth lodges of the Mandan in the Dakotas to the "hogans" of the Navajo who are nextdoor neighbors to the Pueblo tribes.

At some still unknown date before 600 A.D. agriculture was introduced and the Pueblo people soon began to increase in number, as always happens when a dependable cultivated food supply replaces an undependable one obtained by hunting. But the people still continued to live in their pit dwellings for another 400 years, while their numbers increased to the 23,000 mark.

Then some one invented or imported the new type of house, the pueblo—and shortly the fatal decline began.

Why should the Indians have remained healthy so long as they lived in the pit dwellings, only to get into serious trouble as soon as they moved into what looked like much better quarters?

Why, for that matter, do the pit-dwelling Navajo thrive and increase today, while their "apartment"-dwelling neighbors barely manage to hold their own?

The Hogan Better

The answer is plain, Dr. Colton thinks: for life under primitive conditions, a pit-dwelling, such as a Navajo hogan, is really better than the more pretentious-looking pueblo type of house.

The Navajo isn't a bit neater in his ways than the Pueblo; he throws his slops out in front of his house, too, and lets the mess lie right there. But the hogans are scattered, one-family dwellings; there isn't any crowding, and the garbage concentration is consequently much lower. Water is always brought from a distance, so that there is little chance of pollution. Being roughly built, the hogan has an effective automatic ventilating system.

Moreover, the Navajo gets away from his messy accumulations rather frequently. He is a shepherd by principal occupation, and so must keep moving along with his flocks. So old hogans are abandoned and new ones built, possibly many times in one man's lifetime. Contrast that with the generations of persistent life in the pueblos—with Great-grandma's garbage still lying in front of the door.

Another thing makes for occasional change of living quarters among the Navajo. It is a part of their fixed tribal custom that if a person dies in a hogan, that hogan must be torn down. The Navajo do try to carry dying members of their families outdoors, if they are not in the mood for moving at the moment; but sometimes a relative will play them the ill trick of dying in the house, thereby automatically evicting the rest of the family and necessitating the building of a new hogan on clean ground.

In Modern Times

On a somewhat more sophisticated scale, we Caucasians have been repeating the story of the Pueblo. To be sure, the traditional farm boy who leaves the old home isn't migrating from a hogan—though some of them, at that, did come from prairie dug-outs or sod-houses, which were pit-dwellings learned directly from the Indians. If he makes good in the big city, he is privileged to live in a very superior pueblo, with clean water piped in, and sewage piped out, and regular removal of garbage, and nightly janitor service, and all that kind of thing. His dooryard stays clean and he lives.

But if he doesn't do so well, or if a depression hits him, and he has to house himself and his family on the wrong side of the tracks—

"Nearly a fifth of our urban population live in dilapidated houses, generally crowded, and typically lacking private indoor toilets and bathtubs. Nearly half of these substandard homes are also without electric lights and about a quarter of them have no running water," is the grim summary of a recent Government report.

Indians living under conditions more or less analogous to these suffered a 90 per cent population loss in about 25 generations.

The illustration on the cover of this week's SCIENCE NEWS LETTER shows a cliff dwelling at Mesa Verde.

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Science News Letter, January 23, 1937

Teeth erupt earlier in girls than in boys.

WHAT TO DO DURING INFLUENZA EPIDEMICS

No sure way of preventing an attack of influenza is yet known to scientists. There are, however, certain precautions which health authorities and physicians agree should be followed during influenza outbreaks.

For Protection

Make more than the ordinary effort to increase your well-being when influenza, colds and upper respiratory infections are prevalent.

Here are eight rules useful in guarding against the disease:

1. Secure adequate sleep and rest (eight to ten hours' sleep every night with windows open, but under enough covering to keep warm).
2. Eat a moderate, mixed diet and partake freely, at regular periods, of pure water (six to eight glasses daily).
3. Wear clothing to suit the environment, particularly clothing which prevents chilling of the body surfaces and which keeps the body dry.
4. Avoid people with colds, especially those who are sneezing or coughing. There is more danger from contact with those just beginning to feel sick than from those ill enough to be confined to bed.
5. Keep out of crowds as far as possible, especially crowds in closed places.
6. Avoid the use of common towels, wash basins, glasses, eating utensils, and toilet articles.
7. Wash the hands thoroughly before eating.
8. Avoid alcohol and stimulants of all sorts.

For Treatment

If you get the disease, follow these four recommendations to prevent becoming seriously ill.

1. If you have a cold, feel badly, or are feverish, go to bed at once, send for a physician and follow his instructions.
2. Do not take any so-called cures. There is no specific cure for this disease.
3. If you cannot get a doctor, remain in bed, eat a simple diet, take plenty of fluids, such as water, fruit juices, milk, bouillon, hot soups, at frequent intervals. Use a mild cathartic if constipated.
4. Remember that the most important measure for preventing pneumonia or other serious complications is to remain in bed until all symptoms have disappeared and then, under the physician's advice, to return very gradually to your usual physical activities, being sure to rest before you get tired.

PUBLIC HEALTH

Flu Cases Triple in U. S. During Week

INFLUENZA cases more than tripled in number during the week ending January 9, reports from state health officers to the U. S. Public Health Service show. During this week, the latest for which nation-wide figures are available, 12,145 cases were reported as against 3,993 cases for the previous week.

The Middle West was hardest hit, it appears from the reports, though South Carolina reported over seven hundred cases and New York City nearly two thousand. New York State outside of New York City does not require reporting of influenza cases and there was no influenza report from Pennsylvania.

The number of cases, although greater than last year at this time, is still so low that public health authorities do not consider that the disease has reached epidemic proportions as yet in this country. In Europe the situation is apparently more serious. Dr. F. G. Boudreau of the Health Section of the League of Nations has informed the Surgeon General of the U. S. Public Health Service that influenza "was showing an unusually early tendency to assume epidemic proportions in Central and Northwestern Europe, especially in Berlin, Copenhagen and London."

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MEDICINE

Biggest Accident Risk for Front Seat Passenger

THE GIRL in the front seat runs the big risk in motor accidents.

Seventy-five per cent of the severe, crushing facial injuries sustained in automobile accidents occur to the person riding beside the driver, in the experience of Dr. Claire L. Straith, Detroit plastic surgeon. The majority of these victims are young women.

Lacking the support of the steering wheel, which often saves the driver, the guest-passenger is thrown forward more violently at the impact. The passenger's head strikes the instrument board, where projecting handles, knobs and cranks add to the hazard.

Elimination of projecting objects from the passenger's side of the instrument panel should be attempted by motor car engineers, Dr. Straith declares in an article on facial injuries caused by motor accidents. (*Journal, American Medical Association,* Jan. 9.)

The use of "crash padding" on the instrument panel might do much to minimize the seriousness and extent of this type of injury, believes Dr. Straith.

Facial disfigurements resulting from such accidents often cause psychologic handicaps that ruin social and business careers, the Detroit surgeon states. He says:

"The ranks of the unemployed and unemployable are already large enough without adding to their numbers persons physically and mentally handicapped by preventable or curable facial defects."

The plastic surgeon cannot expect good results in face injuries unless the first aid treatment has been carefully done, asserts Dr. Straith.

Plastic procedures, such as correcting scars, crushed facial bones or lost eyebrows, ears and nose, should not be undertaken until two months after every trace of infection has disappeared. He tells physicians how he replaces severed noses, using skin grafts from the forehead of a woman patient and from below the ear of a man patient.

In the same issue of the medical journal, Dr. Lowell S. Selling, also of Detroit, discusses tests for automobile drivers. His recommendations are based on studies made at the psychopathic clinic of the Detroit Recorder's Court, traffic unit.

"Licensing drivers by means of physical and mental tests will be more or less of a farce," Dr. Selling states, "until physicians themselves give examinations to motor car drivers and until they compile data showing just where the line must be drawn between adequate and inadequate physical capacities."

A man with two artificial arms has been driving a car for twenty years without an accident or a violation of the law. But it requires the decision of an experienced and highly trained individual to determine whether such a handicapped person is capable of safe driving, in Dr. Selling's opinion.

A doctor's certificate as to organic soundness can be easily requested by licensing officials, Dr. Selling says, even though the law does not demand it.

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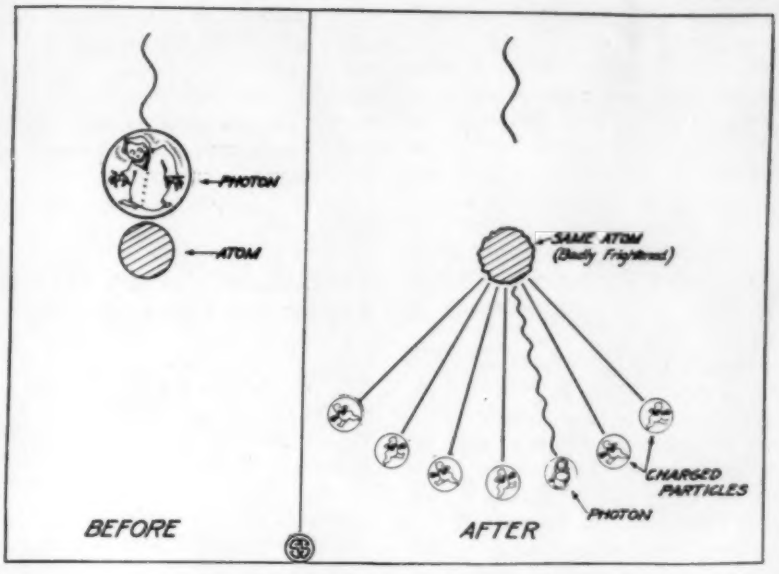

ATOMS TROUBLED BY GHOSTS

PHYSICS

Photons Called the Ghosts Of the Physical Laboratory

GHOSTS have often been suspected of being at the bottom of strange happenings on this earth. But the main claim of the modern scientist is that he has dispensed with such supernatural explanations for earthly events. In the world of modern science a ghost would indeed be a lonely individual!

Nevertheless, some of those fundamental entities of which the material world is believed to be composed behave in a very, very strange way. Those "bundles of energy" called photons are perhaps the worst offenders. Even the physicist is somewhat at a loss when it comes to explaining the antics of a photon. And as far as the layman is concerned—well, perhaps a photon is as much like an old-fashioned ghost as it is like anything else.

Such seems to be—for purposes of popular explanation anyway—the view of Dr. W. F. G. Swann of the Bartol Research Foundation who, speaking informally at the Franklin Institute recently, said:

"A bullet is a kind of thing which can only be at one place at once and which strikes where it is. The electrons and protons (material particles) are like bullets. A ghost is a creepy kind of thing which can be everywhere always, which only strikes at one place at a time but which can strike anywhere." And this unpredictable, ghostly kind of behavior, Dr. Swann went on to say, is characteristic of a photon.

Carrying the analogy still further, the speaker went on to describe how these photon-ghosts terrify the inhabitants of the atomic world. Particularly potent in this respect are the high-powered ones which accompany the cosmic rays. A picture on this page is one which Dr. Swann used to illustrate his talk. It shows what happens when an especially horrendous photon-ghost meets up with an unsuspecting atom.

Except for receiving a severe "mathematical fright" the atom comes through the ordeal without serious harm. But the ghost himself may be so dreadfully annoyed that he actually materializes—comes to life—in the form of particles of matter. Newborn "particles with a punch" are formed which tear through the atmosphere, ripping the outer structure off other atoms.

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From Page 55

temperature. This slower method seems to give the hydrogen in the rail a better chance to escape.

Every time you hear the "click-click" of the wheels of a railroad train passing over the rail joints you are coming into audible contact with another problem being studied in Professor Moore's laboratory.

Special efforts have been made to develop methods for hardening rail ends so that the battering of the joints will be decreased. Just as parents put metal heel plates on the shoes of their active children to decrease wear, so too do the railroads try to find a means for reducing rail end batter.

Rail manufacturers are now equipped to harden the ends of rails by cooling them with an air blast immediately after rolling. They can also be hardened as they lie in place in the track. Some railroads build up battered ends by welding.

From time to time consideration has been given to very long rails, 100 feet in length, but the difficulty of manufacture and transportation have so far precluded their adoption.

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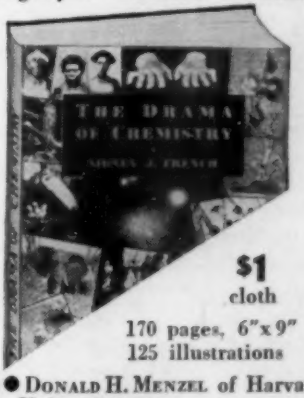

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BIOLOGY

NATURE RAMBLINGS

by Frank Thone

Winter Sleep

WHAT miracles of physiology must be performed every winter, that we may at last see what the poets call the awakening of spring!

For by far the greater part of living things cannot face winter. Either they die, as annual plants do, or they become dormant, as do biennial and perennial plants, all kinds of seeds, many kinds of eggs, and not a few adult animals of the lower orders, or they pass into the deep and deathlike sleep called hibernation. In one way or another they evade winter by partly yielding and partly enduring.

Overwintering plants, dormant seeds and animal eggs, and many of the cold-blooded animals are often said to freeze up solid during the severe weather of January and February, and yet thaw out in spring none the worse for the experience. This is not strictly true. Such organisms do undergo temperature drops to freezing point or many degrees below it. Yet in the strict sense of the word they do not freeze.

Freezing involves the formation of ice crystals. If such crystals form within the tissues of a tree bud, or a seed in the ground, or an overwintering spore of fungus or bacterium or worm of insect or egg, that particular individual is most probably done for. The crystals expand as they freeze, and when they thaw they expand again, and the mechanical injuries they cause to the delicate cell structures are alone able to bring about death. So these manifold forms of overwintering life get rid of much water by one device or another, and by the time hard freezing comes they face it with their protoplasm dehydrated to the consistency of cheese, or perhaps even of horn. Such cell units must be highly resistant to freezing.

To get rid of water in this way of course involves a good deal of evaporation. But evaporation can easily be carried too far, especially in the case of plants that live through the winter with green leaves on them. The dry, cold winds suck moisture out and the roots are unable to put any back in. Hence the importance of varnish-like coverings on tree buds, of snow blankets over winter wheat fields.

Hibernating animals like bears and groundhogs resist cold by keeping just enough of the vital fires going to avoid freezing. Their pulse and breathing rates slow down to an almost deathlike stillness, and their body temperatures drop far below normal for warm-blooded animals, yet they do manage to keep circulation and breath going, and slowly feed their accumulated fat into the slow fires of winter oxidation.

Science News Letter, January 23, 1937

●RADIO

January 26, 5:15 p.m., E.S.T.

PHYSICS AT WORK—Prof. George B. Pegram of Columbia University.

Feb. 2, 5:15 p.m., E.S.T.

QUEER FOODS OR QUEER PEOPLES —Matthew W. Stirling, Chief of the Bureau of American Ethnology.

In the Science Service series of radio discussions led by Watson Davis, Director, over the Columbia Broadcasting System.

SEISMOLOGY

Earthquake Study Has Its Economic Cash Value

KNOWLEDGE of earthquake conditions and possibilities in a given region has tremendous economic significance, in the insurance sense, Capt. N. H. Heck of the U. S. Coast and Geodetic Survey indicated. Because of the growing realization of this, material support for the rapid development of seismology, the science of earthquakes, has come more from those interested in safe building design than from geology.

Southern California, where progressive business leaders have come to face the earthquake problem courageously and with their eyes open, is now one of the foremost regions in the world in the understanding of earthquakes. The great Rocky Mountain region, definitely known to be seismic, is in at least equal need of intensive study, Capt. Heck declared. At present there are only six seismological observatories in the whole vast area, a totally inadequate number, the speaker said. However, new installations of instruments are in prospect, and some are already being made.

Science News Letter, January 23, 1937

Forest fires are not much of a problem in the Caribbean National Forest in Puerto Rico, where the rainfall is over 150 inches a year.

Road magnets, used to pick up nails and other metal on highways, have been known to collect as much as 13 pounds per mile.

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Additional Reviews On Page 64

Anthropology

PLEISTOCENE MAN IN MINNESOTA, A FOSSIL HOMO SAPIENS—Albert Ernest Jenks—*Univ. of Minnesota,* 197 p., illus., $7.50. That America was inhabited by man in the late glacial period, about 20,000 years ago, is the high historic significance which Prof. Jenks assigns to the skeleton of Minnesota Man. In support of this verdict, he presents in this report an impressive background of evidence, including the circumstances of discovery, geology of the region, and a detailed study of skeletal features.

Science News Letter, January 23, 1937

Physics

THE THEORY OF THE PROPERTIES OF METALS AND ALLOYS—N. F. Mott and H. Jones—*Oxford,* 326 p., $8. An advanced and highly technical book which gives as complete an account as is now possible of the electron theory of metals and of its successes in accounting for the observed properties of metals and alloys.

Science News Letter, January 23, 1937

Mathematics

LES CONDITIONS DE MONOGÉNÉITE —D. Menchoff—*Hermann & Cie, Paris,* 53 p., 15fr.

Science News Letter, January 23, 1937

Mathematics

PROPRIÉTÉS GENERALES DE L'ÉQUATION D'EULER ET DE GAUSS—Édouard Goursat—*Hermann & Cie, Paris,* 93 p., 20fr.

Science News Letter, January 23, 1937

Geometry

ANALYTIC GEOMETRY—Palmer H. Graham, F. Wallace John and Hollis R. Cooley—*Prentice-Hall, Inc.,* 294 p., $2.35. A text used at Washington Square College of New York University. No special claims for novelty are offered by the authors, except that the material is presented so that it may be grasped by the average student and at the same time give the instructor a highly flexible text to fit into his own course.

Science News Letter, January 23, 1937

Animal Husbandry

THE MORTGAGE LIFTER — *Hog Breeder, Inc.,* 255 p., $2.25. Nobody with a Midwestern background will need to be told what kind of a mechanism a mortgage lifter is, or how efficiently it functioned in days when America still had an export market. In these days of closer margins between production costs and selling prices, when no hog raiser can afford to have any four-hoofed prodigal sons (or daughters) in the feed lot, this compact practical book, taking up hog breeding and hog raising from all angles, will be found valuable.

Science News Letter, January 23, 1937

Aeronautics

AIRCRAFT AND THE AIR—Compiled and edited by Eric Sargent—*Appleton-Century,* 682 p., illus., $3. Line drawings and specifications of aircraft, past and present, of all nations are compactly provided by this interesting book for ready reference.

Science News Letter, January 23, 1937

Mathematics

FIRST YEAR COLLEGE MATHEMATICS —M. A. Hill and J. Burton Linker—*Holt,* 436 p., 155 p. of tables, $2.60. A University of North Carolina text which breaks down into three broad topics: (1) Algebra and trigonometry, (2) Analytic geometry and (3) Mathematics of finance. There are 155 pages of mathematical tables to help in the solution of problems and as a reference tool.

Science News Letter, January 23, 1937

Electricity

LESSONS AND PROBLEMS IN ELECTRICITY—Newell C. Page—*Macmillan,* 356 p., $2.75. A Massachusetts Institute of Technology text which assumes freshman calculus and mechanics. The electron theory is stressed throughout the book which, as might be suspected, is designed for engineering students. Many teachers will value it for its collection of problems although the title is misleading in that much more is offered than the usual "problem" book.

Science News Letter, January 23, 1937

Chemistry

CHEMICAL BUYER'S GUIDE-BOOK, 1936—Staff of "Chemical Industries"—*Haynes Publications,* 919 p., $1.

Science News Letter, January 23, 1937

Physics

ELECTRON TUBES IN INDUSTRY (2nd ed.)—Keith Henney — *McGraw-Hill,* 539 p., $5. With the help of 28 experts in the field, Mr. Henney, who is editor of the well-known magazine *Electronics,* here brings his popular reference book up to date.

Science News Letter, January 23, 1937

History of Mathematics

THE STUDY OF THE HISTORY OF MATHEMATICS — George Sarton—*Harvard Univ. Press,* 113 p., $1.50. The inaugural address by Prof. Sarton in his course on the subject of this book, at Harvard University, February 4, 1936.

Science News Letter, January 23, 1937

Geology

AN ISLAND IS BORN—Norah D. Stearns—*Honolulu Star Bulletin, distributed through Harold T. Stearns, Spreckelsville, Maui, T.H.,* 115 p., illus., $1. A popular geologic account of the evolution of the Island of Oahu, on which Honolulu is situated. The vivid impressionistic style should prove attractive to trans-Pacific travelers. Lots of illustrations and diagrams fill the book.

Science News Letter, January 23, 1937

Aeronautics—Meteorology

THE NATIONAL GEOGRAPHIC SOCIETY-U. S. ARMY STRATOSPHERE FLIGHT OF 1935 IN THE BALLOON "EXPLORER II"—*Nat. Geographic Soc.,* 277 p., illus., $1.50. Complete scientific findings of the 1935 stratosphere flight in both technical and non-technical language. Many original photographs and diagrams lend interest.

Science News Letter, January 23, 1937

Physical Chemistry

ELEMENTARY PRINCIPLES IN PHYSICAL CHEMISTRY—T. J. Webb—*Appleton-Century,* 344 p., $4. A Princeton University text for juniors and seniors in college. The content of the book revolves, states the author, around those two fundamental problems of theoretical chemistry—the state of equilibrium in a chemical reaction and the rate at which the state of equilibrium is attained.

Science News Letter, January 23, 1937

VITALISM
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Additional Reviews On Page 63

Ichthyology

MARINE FISHES OF SOUTHERN CALIFORNIA—Percy Spencer Barnhart—*Univ. of California,* 209 p., illus., $4. Pages 1 to 95 are descriptive text, concise, accurate, provided with necessary "keys"; pages 99 to 186 show forth 290 cleanly made line illustrations of species described in the text; the rest is glossary, bibliography, and index. Altogether this is a book that will be extremely useful for the region it covers, and one which other authors might well take as a model for similar treatment of the fauna of other regions. Mr. Barnhart, a veteran member of the Scripps Institution staff, has spent many years in accumulating the data which he here makes available in an admirable combination of comprehensiveness and condensation.

Science News Letter, January 23, 1937

Physics

RELATIVITY THEORY OF PROTONS AND ELECTRONS— Sir Arthur Eddington—*Cambridge* (*Macmillan*), 329 p., $5.50. See page 53.

Science News Letter, January 23, 1937

General Science

SCIENCE IN DAILY LIFE—Gilbert H. Trafton and Victor C. Smith—*Lippincott,* 689 p., $1.68. A high school text in general science with above-the-average illustrations.

Science News Letter, January 23, 1937

Electricity and Magnetism

PRINCIPLES OF ELECTRIC AND MAGNETIC MEASUREMENTS—P. Vigoureux and C. E. Webb—*Prentice-Hall,* 392 p., $5. From the National Physical Laboratories of Great Britain come these two authors to acquaint students of physics or electrical engineering with the principles and practice underlying electricity and magnetism.

Science News Letter, January 23, 1937

Parasitology

CONTROL OF ANIMAL PARASITES, GENERAL PRINCIPLES AND THEIR APPLICATION—Maurice C. Hall—*North American Veterinarian,* 162 p., $2. Probably no man living knows animal parasitology more thoroughly from a scientific standpoint than does Dr. Hall, who has served his country with distinction in both the Department of Agriculture and the Public Health Service; nor has he many peers in the combination of imagination and practicality necessary for successful effort against parasite-induced diseases. In this book he follows throughout a most stimulating analogy of military action: effort against any given parasite species is seen as war, campaigns are planned, heavy and light artillery posted, mop-up troops sent in at the right moment. It all serves to vivify what must seem at times, especially to younger sanitarians, a rather dirty and dreary job—not unlike real war in that respect, either. But quite unlike war in being wholly beneficial in results.

Science News Letter, January 23, 1937

Physics

AN ELEMENTARY SURVEY OF MODERN PHYSICS—Gordon Ferrie Hull—*Macmillan,* 457 p., $4.50. A second-year text for colleges following the first course in general physics. Emphasis is less on the technical side of the field of modern theories of the atom than on the development of the atom idea, methods of estimating the dimensions and properties of atoms and tentative proposals on the possible structure of the atom.

Science News Letter, January 23, 1937

Engineering

DIESEL ELECTRIC PLANTS—Edgar J. Kates—*American Technical Society,* 181 p., $2. Another of the ever increasing number of handbooks and survey books on diesel engines, their characteristics and operation.

Science News Letter, January 23, 1937

Mathematical Physics

GEOMETRY OF TIME AND SPACE—Alfred A. Robb—*Cambridge* (*Macmillan*), 408 p., $7.50. The author attempts to give mathematical form to a conception of time-space relations not based on assumptions as to the simultaneity of events at different places. It is the second edition of a book published in 1914 under the title, *A Theory of Time and Space.*

Science News Letter, January 23, 1937

Mathematics

PROGRESSIVE PLANE AND SOLID GEOMETRY—Walter W. Hart—*Heath,* 581 p., $1.60. A complete text on the subject with a wealth of problems. The low cost permits few of the modern-type book "dress-ups" to be used, so that the husky volume looks like all work and no play for the oncoming generation of students.

Science News Letter, January 23, 1937

Botany—Meteorology

CYCLES IN TREE-RING WIDTHS—C. G. Abbot—*Smithsonian Institution,* 5 p., 5c. Pursuing further the studies which showed him a 23-year cycle in tree-ring widths, Dr. Abbot now finds multiples of that basic number in cycles of 46 and 92 years respectively.

Science News Letter, January 23, 1937

Mathematics

THE ASYMPTOTIC DEVELOPMENTS OF FUNCTIONS DEFINED BY MACLAURIN SERIES—Walter B. Ford—*University of Michigan Press,* 143 p., $2. Volume eleven in the University of Michigan series of scientific studies. A very advanced monograph on a specialized type of series expansion.

Science News Letter, January 23, 1937

Calendar Reform

CALENDAR REFORM, WHAT DOES IT MEAN?—Alvin W. Johnson—*Broadview Press,* 173 p., $1.50. A discussion that holds that a new calendar satisfactory to business must also be satisfactory to religion. Opposition is expressed to any attempt that makes use of a blank day or fails to preserve the weekly cycle.

Science News Letter, January 23, 1937

Physics

BEYOND EINSTEIN, A RE-INTERPRETATION OF NEWTONIAN DYNAMICS—Theodore Stalzer—*Dorrance,* 170 p., $2.50. Critical discussion of relativity theory and a re-interpretation of Newtonian principles.

Science News Letter, January 23, 1937

Physics

A SURVEY COURSE IN PHYSICS—Carl F. Eyring—*Prentice-Hall,* 378 p., illus., $3. Text for an orientation course in physics for non-science students. The author, dean of sciences at Brigham Young University, warns that the book is in no way intended to replace the general texts on the subject.

Science News Letter, January 23, 1937

Electricity

GENERAL ELECTRICAL WORK; AN ELEMENTARY COURSE, PROBLEMS, PROCESSES, RELATED INFORMATION—George A. Willoughby—*Manual Arts Press,* 95 p., 56c. A practical, compact book which will enable the novice—or even Mrs. Novice—to fix many of those electrical gadgets around the house.

Science News Letter, January 23, 1937